DISCUSSION OF U. S. INTELLIGENCE NEEDS ON SOVIET BALLISTIC MISSILE DEFENSE (BMD)

INTRODUCTION

The size and quality of deployed Soviet BMD have a primary influence on the size and nature of U. S. strategic offensive forces and on the way we plan for use of these forces if deterrence fails. For these reasons, some level of intelligence activity must always be directed at Soviet anti-ballistic missile (ABM) development and deployment programs.

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Soviet BMD. The question addressed in this paper is what are these needs, if any, to support R&D, force planning and war planning decisions.

SUMMARY AND CONCLUSIONS

This paper reviews the strategic rationale for intelligence on Soviet BMD; it uses this rationale, projected Soviet BMD and programmed U. S. Strategic Offensive Forces data to justify a statement of intelligence needs. The paper reaches the following conclusions:

1. Programmed U. S. forces were designed for a much larger Soviet BMD than that now projected.

2. The deployments of some U. S. programmed forces have been slowed recently in response to sharp downward revisions in the estimates of Soviet BMD forces made over the period 1966-1969. These forces were programmed in response to an earlier, much larger projection of Soviet BMD for the 1970-1975 period.

3. Current projections of Soviet BMD are that it will be, practically, all area defense.

4. Discovery that the projected Soviet BMD has serious vulnerabilities is unlikely to result in reduced U. S. expenditures for strategic offensive forces.

5. Confirmation of the vulnerability of BMD to chaff might permit saving a relatively modest number of U. S. lives (by executing heavier attacks on Soviet land based ICBMs) in the event of nuclear war which included city attacks. The Soviets could and probably would reduce this benefit, however, by relying, at least in part, on forces for attacks on our cities not vulnerable to U. S. ballistic missiles, e.g., alert bombers or submarine launched ballistic missiles.

6. Radar blackout is not likely to be a desirable penetration mode against projected Soviet BMD because it is likely to be nearly as expensive as interceptor exhaustion. Electronic counter measures are not likely to be relied on because of high risk. Maneuverable reentry vehicles are not now programmed and are unlikely to be because of their great complexities and expense.

7. Because programmed U. S. forces are now very conservatively designed, we are not very vulnerable to surprises. We should, however, be alert for interceptor refire capability and conversion of the SA-5 to an ABM. Both these events, though very unlikely, could make relatively rapid changes in Soviet BMD capability.

8. Our forces are designed to tolerate a sizable Soviet Sprint like terminal interceptor deployment; however, because evidence of such a missile in the Soviet Union would signal a major advance in Soviet BMD technology, early discovery of such a development would be of great interest.

THE ABM INTELLIGENCE PROBLEM

U. S. Strategic Objectives

The U. S. has four objectives related totally or in part to BMD of Soviet cities.[1/] These are:

1. To dissuade the Soviets from deploying a larger BMD.

2. To deter nuclear war whether or not a Soviet BMD is deployed.

3. If deterrence fails, to discourage attack on U. S. cities by threatening Soviet cities with destruction while exercising control and restraint in the use of committed U. S. strategic offensive forces.

1/ Though the Soviets could elect to deploy ABM defenses solely for the purpose of defending their land based strategic offensive forces, such defenses would affect our strategic decisions in only secondary ways unless these defenses could also defend Soviet cities. In the latter event our current planning practices would require our viewing such defenses as a city BMD. This paper deals only with ABMs defending cities since no Soviet defenses of strategic forces are projected in existing intelligence documents.

4. If deterrence fails and if city attacks are initiated by the Soviets, to be able to destroy a substantial part of the Soviet urban industrial base.

In addition, we wish, of course, to achieve these strategic objectives at minimum cost.

Whether we can achieve the first three of these objectives depends upon how the Soviets estimate our capabilities and their own; therefore, when we talk about the capabilities of Soviet BMD, we should in fact be talking about Soviet estimates of the capability of their BMD, since it is these Soviet estimates which in part affect Soviet attitudes toward nuclear war. Whether we can achieve the fourth objective depends not on Soviet estimates but on the true capabilities of Soviet BMD. Ideally, then, we need to know not only the true capabilities of Soviet BMD, but what the Soviets think these capabilities are. The importance of this distinction will be evident in the ensuing discussion.

Objective 1 - Dissuasion of Soviet ABM Deployment. We do not know how the Soviet bureaucracy makes major strategic forces decisions. We therefore do not know with confidence what actions we should take to dissuade the Soviets from an ABM deployment. Our options range from arms control agreements to advance deployment of weapons to counter expected Soviet BMD. One important option is to confront the Soviets with a range of developmental penetration devices, the countering of which will make an effective ABM system extremely expensive even at low defense deployment levels and will reduce the Soviets' confidence that their BMD will work. It is desirable, of course, that the deployment of such devices be substantially cheaper than the deployment of enough ABMs to counter them. Examples of such devices are chaff, atmospheric decoys, electronic countermeasures, precursor nuclear bursts, boost glide reentry vehicles and maneuvering reentry vehicles. Our Advanced Ballistic Reentry System (ABRES) development program is at least partly intended, along with other efforts, to provide just such dissuasion.

Such an approach imposes few intelligence requirements since our ABRES effort is driven largely by our own ABM technology, which is now and is likely to remain several years ahead of corresponding Soviet technology.

Objective 2 - Deterrence of Nuclear War. We deter the Soviets primarily by maintaining forces sufficient to retaliate after a first strike and destroy the Soviet Union, even under very conservative assumptions about the effectiveness of Soviet forces and how those forces would be used.

Because procurement of forces takes a long time, the BMD estimates which are useful to force planners must be estimates of future BMD

capabilities. Our estimates of Soviet ABM performance strongly influence the size and hence the costs of our strategic forces and the use to which such estimates are put influences the nature of the estimates required. Consider the highly simplified payoff table below:

		Soviet Estimate of Soviet ABM Performance	
		Works	Does Not Work
U. S. Estimate of Soviet ABM Performance	Works	U. S. Forces Properly Designed	U. S. Forces Over Designed
	Does Not Work	U. S. Forces Under Designed; Deterrence Compromised	U. S. Forces Properly Designed

In this table the term "Works" implies that the Soviet BMD functions in accordance with some specified mode of operation. One mode might be, e.g., that area defense is nationwide random, that radars can see through chaff, that city terminal defenses are subtractive, that radars can discriminate decoys, and that both interceptor types must be exhausted. The term "Does Not Work" implies that a major vulnerability exists in the system which if exploited would permit penetration by substantially smaller attacking forces than if the system "works." The payoff table suggests that the U. S. will not design its forces on a "Does Not Work" estimate unless we are virtually certain the Soviets also estimate that the ABM "Does Not Work." Otherwise, regardless of the true capabilities of the ABM, deterrence might fail, and enormous political and military consequences could flow from such a failure.

The payoff table above could be expanded by arraying along its edges a complete spectrum of performance possibilities (or conversely but equivalently, penetration modes) for the Soviet BMD. Assume for the moment that there are five such penetration modes, Q(1) through Q(5) where the cost to the U. S. to exploit Q(1) is higher than Q(2), cost to exploit Q(2) is higher than Q(3) etc. The table then might look as below:

		Soviet Estimate of Soviet BMD Performance				
		Q(1)	Q(2)	Q(3)	Q(4)	Q(5)
U. S. Estimate of Soviet BMD Performance	Q(1)	U. S. Forces Properly Designed	U. S. Forces Over Designed			
	Q(2)	U. S. Forces Under Designed				
	Q(3)					
	Q(4)					
	Q(5)					

The intelligence task then is to find, for each of a list of exploitable penetration modes (Q(1), Q(2) ... Q(5)), the probability that the Soviets will estimate that they will be able to defeat it. This implies that U. S. decision-makers will examine our intelligence data on both the BMD and on what the Soviets think of the BMD to see if Q(5) is available to us. If they can say virtually positively that Q(5) is not available then they will examine Q(4), then Q(3), etc., until they find a penetration mode which can be exploited and which the Soviets will also believe is exploitable.

For force structure design, all of our estimates must be for a future ABM system. If Q(1) through Q(5) are visualized as penetration modes such as radar blackout, exhaustion, rate saturation, etc., the intelligence task boils down to making high-confidence estimates, of which, if any, of these penetration modes will be available. The intelligence data required is that data needed for this specific decision.

Objective 3 - Deterrence of City Attacks During a Nuclear War. If deterrence fails and a nuclear war starts, we hope to avoid attacks on our cities by holding Soviet cities hostage to withheld U. S. forces sufficient to destroy Soviet cities if they initiate city attacks. Just as for objective 2, the size and types of forces we withhold must be persuasive to the Soviets. Hence, their estimate of their BMD performance is again one of the crucial parameters. The main difference between the two objectives is that of time--future BMD capabilities are pertinent to analyses of our deterrent of nuclear war, present and near future capabilities are pertinent to war planning which in turn determines the forces we withhold for city attacks.

Objective 4 - Destruction of Soviet Cities. This objective requires that we know the truth about available Soviet BMD penetration modes. Again, however, we must have very high confidence in our estimates, since an underestimate of Soviet BMD capabilities could result in a failure to destroy their cities if that became necessary. Such failure would in some sense imply losing the war.

This discussion of the implications of U. S. strategic objectives relative to Soviet BMD is summarized in the following table.

U. S. Objective	U. S. Decisions Involved	Estimate Needed	Time of the Estimate	Confidence Required
1	R & D	Most difficult Penetration Modes to counter	Far Future	Moderate to Low
2	Force Structure	Soviet Estimate of available Penetration Modes	Mid Range Future	Very High
3	War Planning	Soviet Estimate of available Penetration Modes	Present and Near Term Future	Very High
4	War Planning	Penetration Modes truly available	Present and Near Term Future	Very High

In sum, we should be trying to estimate penetration modes with very high confidence for both the mid-range period and the near future. Our collection needs should be tailored to these estimate requirements. If we cannot make detailed performance estimates of the required quality, we should not expend large sums on such estimates.

CURRENT KNOWLEDGE AND PROJECTIONS OF SOVIET BMD

Order of Battle

Table I shows our current projection of Soviet BMD order of battle. These data show that significant terminal defenses are not expected before about 1976. Figure 1 shows how our estimate of total order of battle has changed as a function of the date on which the estimate was made. This figure shows that we have made large downward revisions of Soviet order of battle since late 1965. The figure also shows that we greatly overestimated Soviet BMD for those years now past.

Table I

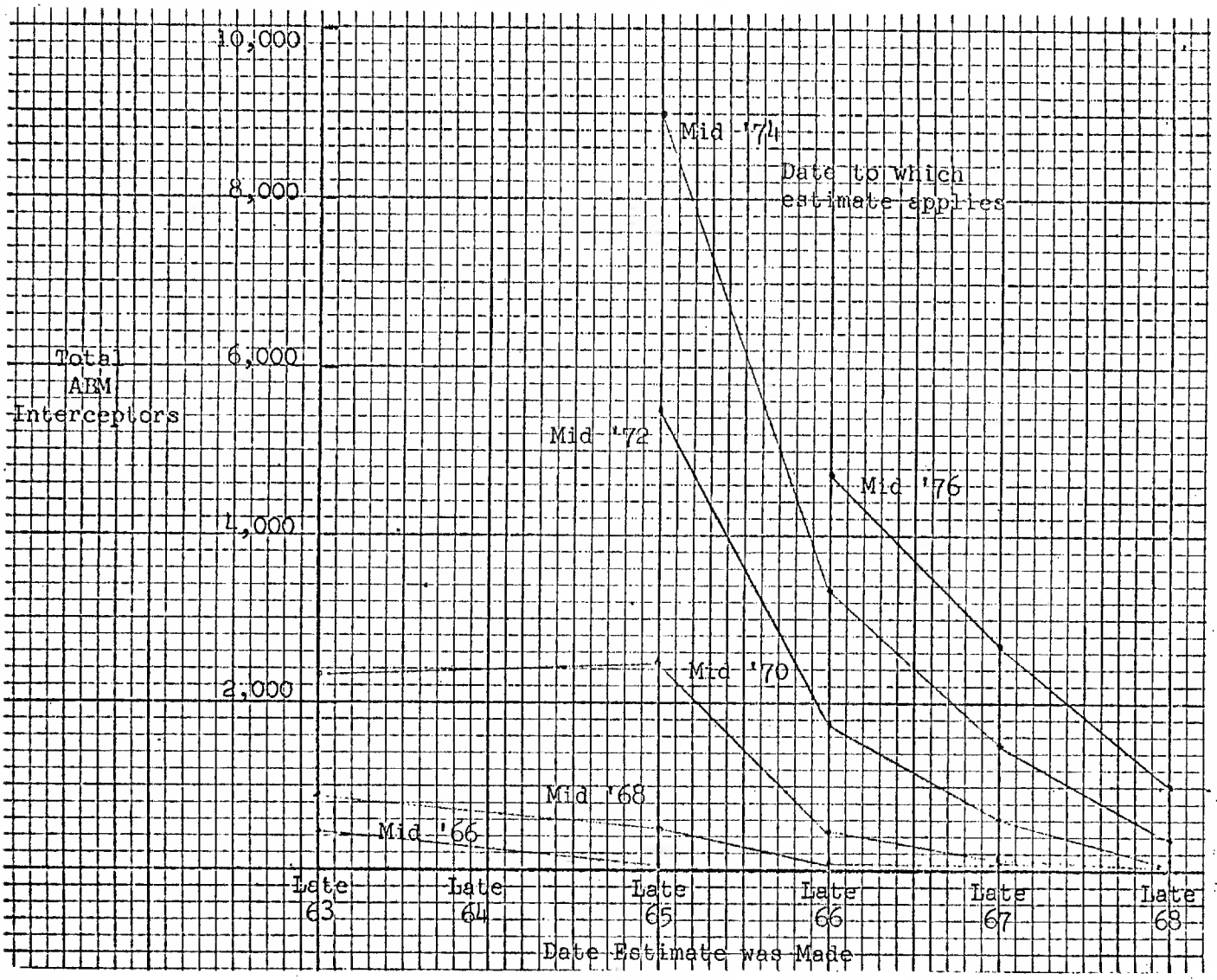
Estimated Soviet ABM: Source NIPP-69

	68	70	72	74	76	78
Area Interceptor Launchers	24-24	56-64	64-64	64-344	214-884	464-1064
Terminal Interceptor Launchers	0-0	0-0	0-0	0-0	0-120	0-600
Total	24-24	56-64	64-64	64-344	214-1004	464-1664

Figure 1 1/ 2/

History of U. S. Estimates of Total Soviet ABM Order of Battle

(Data are High National Intelligence Projections for Planning (NIPP) Estimates)



1/ These data do not include the Tallinn system. High NIPP data are shown since the High NIPP drives force structures in the out years and low and high are usually equal in near future years.

2/ The lines drawn on this figure do not imply continuous estimate changes; estimates were published late in the year in the NIPPs, e.g., NIPP-69 was published in late '68, etc. The lines are mostly for clarity in showing related points and trends. Intelligence Assumptions for Planning (IAP) data were used for "late 63" data points.

Qualitative Characteristics

National estimates have not included estimates of the performance of Soviet BMD. For example, the estimates have not dealt with those factors which might cause the Soviet ABM to be vulnerable to chaff. The estimates, also, have not provided data from which a determination can be made of the firing doctrine or operational mode of the Soviet area ABM. For example, the intelligence estimates have not specified whether the area defense would be subtractive, random, pre-committed or preferential. In the absence of such estimates, the following has been generally assumed for force structure design purposes:

1. The area ABM will work and will perform in a random mode. Area interceptors must be exhausted for any penetration to occur.

2. The area ABM will be vulnerable to chaff (the opposite assumption has also been used to examine less likely U. S. offensive force performance).

3. Any area interceptor can defend any part of the Soviet Union.

There has been general acceptance that the projected Soviet area ABM will not perform better than set forth in 1 through 3 above. The acceptance has been informal in the sense that the Draft Presidential Memoranda, the Department of Defense Strategic Force and Effectiveness Tables and other similar documents have been based on this performance description, without objection from either the intelligence community or others.

PENETRATION MODES OF PROJECTED SOVIET ABM

Practically, the projected Soviet ABM is an area defense in the 1970-1976 period. Assuming the Soviets will defend their radars from direct attack, penetration modes other than exhaustion with armed reentry vehicles might be available.

1. Use of area penetration aids (e.g., chaff) as well as reentry vehicles to exhaust the ABM.

2. Use of radar blackout to either destroy the defense or to penetrate it.

3. Use of maneuverable reentry vehicles to absorb several Soviet interceptors per U. S. reentry vehicle.

4. Use of electronic counter measures (ECM).

PROGRAMMED U. S. FORCE CHARACTERISTICS

In the 1976 period, we will have deployed MINUTEMAN IIs, MINUTEMAN IIIs, POLARIS A-3 and POSEIDONS. Table II below shows the number of area interceptors per missile each can absorb if programmed area penetration aids work as they have been designed to work.

Table II

Area Interceptors U. S. Missiles can Absorb With and Without Area Penetration Aids

	Without Area Penetration Aids	With Area Penetration Aids
MINUTEMAN II	1	9
MINUTEMAN III	3	15
POLARIS A-3	1	1
POSEIDON	10	10

Table II suggests some payoff if we know that area penetration aids work; however, the existence of the large POSEIDON force, which has a large number of warheads and no penetration aids, will reduce the value of such information considerably.

Radar blackout is likely to be a high risk penetration mode even with good intelligence since the tactics required are complex. In addition, if the ABM order of battle is small, as projected for the mid-70s by NIPP-69, blackout might not be much more efficient than penetration by exhaustion. It is unlikely that we would rely on radar blackout (even though we might use it to supplement other tactics) for either force structure design or war planning. In this regard, only our MK 12 reentry vehicles will have a precursor burst capability, a prerequisite to the use of radar blackout. We do not have large warheads programmed capable of providing such bursts.

Maneuverable reentry vehicles are not now programmed for our strategic offensive forces, nor is it likely that they will be even if a larger Soviet BMD is projected. This results from such factors as the likely expense of such systems and the large payload capability already available in U. S. forces.

ECM is most likely to be used as an adjunct to other more reliable penetration modes. Because its success is highly dependent on Soviet

electronic system capabilities, some of which we might be unable to learn about short of fighting a war, we are unlikely to rely on ECM heavily.

CAPABILITIES OF PROGRAMMED U. S. OFFENSIVE FORCES

For Assured Destruction

Table III shows a number of U. S. programmed force capabilities against the High NIPP-69 strategic offensive and defensive threat in an Assured Destruction test. Our retaliatory requirements are the main determinants of U. S. forces. In this test U. S. forces are attacked by the full weight of alerted Soviet offensive forces. U. S. forces receive tactical warning only (permitting launch of alert bombers) and attack the Soviet Union's urban industrial target system through alerted Soviet defenses. This is the worst that could happen to U. S. forces, given the High NIPP threat.

Table III

U. S. Strategic Offensive Force Performance Against Soviet High NIPP-69 Threat, Assured Destruction Test

	70	72	74	76
Surviving Reliable Missile Warheads at Area Defenses	90	1904	2840	2883
Surviving Reliable Area Objects at Area Defenses	2587	5631	6734	6449
Surviving Reliable Terminal Objects at Terminal Defenses	1364	2083	2891	3333
Surviving Reliable Missile Warheads at Terminal Defenses	906	1904	2752	2608
Detonating Missile Warheads	902	1876	2723	2570
Percent Soviet Fatalities, Missiles Only	43	44	44	43
Percent Soviet Fatalities, All U. S. Forces	43	45	45	44
Percent Soviet Fatalities, All U. S. Forces, No Penetration Aids	43	44	44	41
Percent Soviet Fatalities, Bombers Only	29	26	12	17

This table shows that U. S. forces are designed very conservatively given the projected Soviet ABM threat. For example in 1976:

1. Almost 2900 reliable U. S. missile warheads can be expected to be delivered to Soviet area defenses. Maximum projected Soviet area ABM reliable order of battle is about 650 interceptors.

2. If U. S. area penetration aids work, about 6400 targets (warheads and chaff) can be delivered to the Soviet area defenses.

3. If U. S. area penetration aids work, about 2600 missile reentry vehicles can be delivered to Soviet terminal defenses. Projected Soviet reliable terminal interceptor order of battle is 90 such interceptors.

4. If U. S. area penetration aids don't work, about 2250 warheads can be delivered to these terminal defenses.

5. If the Soviet ABM will not work at all, and if we know before the war that it will not work, Soviet fatalities would not be significantly increased (about 1%) because the marginal benefits of delivering warheads is very low at fatality levels in the 40% to 50% range.

6. Even though projections of Soviet ABM, made over the 1966-1969 period, have decreased by very large amounts, our programmed forces have changed only slightly.

In sum, our forces are extremely capable against the High NIPP-69 ABM threat. Additional knowledge of vulnerabilities in this threat will not meaningfully improve the estimated performance of our programmed forces. It seems unlikely that knowledge of vulnerabilities in this ABM will result in procurement of smaller U. S. forces.

For War Fighting

The paper at Tab A discusses the sensitivities of the performance of U. S. forces in war fighting scenarios to ABM information. The conclusion of the paper at Tab A is that U. S. force performance is quite insensitive at ABM levels in the neighborhood of those projected by NIPP-69. It should be noted that the smallest ABM estimate used in the paper at Tab A is about twice as large as the High NIPP-69 projection for mid-1976 and almost two and one half times the mid-range estimate for mid-1976 in NIPP-69. This suggests that the value of information on Soviet ABM vulnerabilities is likely to be very low given NIPP-69 projections, likely employment of Soviet forces and U. S. programmed forces.

HEDGING SOVIET ABM DEPLOYMENTS GREATER THAN NIPP-69 PROJECTIONS

U. S. Strategic Offensive Forces have substantial capacity to tolerate increases in projected Soviet ABM. Events that would be of some significance that ought to be watched for are:

1. Refire capabilities that would permit more than one ABM interceptor to be launched from a single launcher.

2. Conversion of an air defense system, i.e., the SA-5, to an ABM.

3. Development of a Sprint like terminal interceptor.

The first and second of these could imply a sudden change in projected Soviet ABM order of battle. Depending on the number of refires and the rate of conversion of the SA-5, these developments could be serious ones.

Our programmed forces have a substantial capability to accept a Soviet terminal defense once our multiple independent targeted reentry vehicles are deployed on POSEIDON and MINUTEMAN III. The development of a Sprint like terminal interceptor would, however, imply significantly improved Soviet ABM technology.

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THE VALUE OF INFORMATION ON THE PERFORMANCE OF ANTI-BALLISTIC MISSILES IN WAR PLANNING

Introduction

Estimates of present or prospective performance of enemy anti-ballistic missiles (ABM) enter into at least three classes of DoD activities:

1. Formulation of R&D programs.

2. Formulation of future force structures.

3. War planning for strategic nuclear warfare.

The first two require estimates of future enemy ABM capabilities because these two activities affect future U.S. capabilities. Relevant estimates are generally of enemy capabilities three or more years in the future because at least this much time is required to make significant changes in programmed forces.

War planners for strategic nuclear warfare can use estimates of present or very near future ABM capability because war plans can be developed or changed on short notice. The effect of such war plan changes is to utilize existing strategic forces in different ways. If a war planner knows that a Soviet ABM is ineffective so that it can be penetrated by techniques that do not require ABM interceptor exhaustion, he can reallocate weapons to save U.S. lives.

Purpose

The purpose of this paper is to estimate the number of U.S. lives that might be saved if a war planner knew that a deployed Soviet ABM could be penetrated without exhausting its interceptors.

Conclusions

1. If the U.S. knows that a Soviet ABM is totally ineffective, under likely conditions of intelligence uncertainty, targeting, Soviet ABM order-of-battle (OB)[1/], performance of U.S. forces and in likely scenarios, about 1 to 3.5 million U.S. lives might be saved.

2. Under much less likely conditions, this reduction in U.S. fatalities might rise to between 1.5 and 9.5 million.

1/ ABM OB in this study is based on the number of launchers projected in NIPP-68. These launchers are assumed not to be reloaded during the battle.

3. The only way these estimates could be significantly increased are: (a) to project a much larger Soviet OB than used in this study; (b) assume, if the Soviet ABM works, that U.S. penetration aids, especially chaff, do not work; or (c) assume, if Soviet ABM works, that the area defense performs in a precommitted or a preferential mode. This latter assumption is roughly equivalent to a gross increase in projected Soviet area ABM OB.

The General Nature of U.S. Strategic Nuclear War Plans

Our strategic nuclear war plan, the Single Integrated Operating Plan (SIOP), contains three tasks: (1) destruction of Soviet strategic nuclear offensive capabilities (Task A); (2) destruction of Soviet conventional warfare forces (Task B); and (3) destruction of a large part of the Soviet urban industrial system (Task C). These three tasks are arranged in "attack options", the selection of which determines which tasks will be performed. In addition, the SIOP contains numerous special features not relevant to the problem of this paper.

Tasks A and C are especially interesting in this analysis. The extent to which Task A is performed, in certain scenarios, influences the number of fatalities the Soviets can inflict on the U.S. Task C, if it must be performed, determines in some final sense who "wins" the war. More importantly, the assured ability to perform Task C is not only the pre-war deterrent but is also the intra-war deterrent to inhibit growth of a counterforce strategic nuclear war to a very destructive counter urban war. Because of the importance of Task C, it has first call on strategic military forces. After forces are assigned to Task C to insure its performance, forces are then assigned to Tasks A and B.

Because Task A targets (strategic offensive forces) generally have short reaction times, they are considered time sensitive and have high priority for attack by ballistic missiles. Task B targets are much less time sensitive and may consequently be attacked effectively with bombers. Task C, though not time sensitive, should, however, have weapons assigned to it which can be withheld for a long time without their being destroyed by enemy action--they should have enduring survivability. With present and foreseeable technology and economics, only ballistic missiles (sea based and land based) will have this property. Tasks A and C, therefore, compete for the same limited resources--ballistic missiles. If bombers can be given enduring survivability, they could also be assigned to Task C; as discussed later, such assignment would reduce the value of knowing an ABM is ineffective. The assumption that bombers are not used in Task C, therefore, tends to increase the values of ABM intelligence estimated in this study.

If, to perform Task C, ABMs must be penetrated, missile delivered weapons must be set aside in Task C forces for this purpose. The number set aside is determined by ABM OB and by the estimated performance capabilities of this OB. If high confidence estimates of reduced performance can be made, fewer weapons need to be assigned to Task C; this frees weapons for Task A. The addition of weapons to Task A should enhance our ability to strike at Soviet forces assigned to their Task C thereby reducing U.S. fatalities.

The study reported in this paper is of the fatality reductions that can be obtained under certain interesting cases of war outbreak, Soviet war planning, and intelligence on the performance of Soviet ABM.

Confidence Requirements in Estimates of Enemy ABM Performance

Properly functioning strategic nuclear defenses must virtually exclude penetration of nuclear weapons; otherwise, the defenses themselves can be brought under attack and destroyed. This characteristic of strategic defenses causes them to exact an "entry price" which must be paid in offensive weapons. Performance estimates of the defenses are in effect estimates of the entry price. If the entry price to a defended target is underestimated by the attacker, the defended target is likely to escape without damage. If the entry price is overestimated, an inefficient offensive weapon allocation results and the defended target will be "over killed".

Since an underestimate results in large negative payoffs to the attacker and an overestimate in offsetting relatively small positive and negative payoffs, only very high confidence estimates of reduced performance are likely to be acted upon by war planners.

Description of Calculations Performed

The Scenario

The scenario assumed was that both sides received warning and were able to alert opposing strategic forces. The Soviet Union (Red) struck first at U.S. (Blue) strategic offensive forces. Blue then struck back at Red strategic forces. After this, both sides attacked each others' cities.

The Force

Red offensive forces were in the mid-range for 1976 as projected by NIPP 68. Blue forces were as programmed for mid-76. Both sides were assumed to use bombers only against Task B targets. This assumption in effect removed all bombers (but not bomber bases) from the problem. This assumption is discussed later.

Red ABM OB was varied and is specified where the results of the calculations are shown.

Both area and terminal penetration aids are assumed to work for both Red and Blue.

Target Systems

Both Red and Blue counterforce target systems were determined from NIPP-68 and the FYDP respectively. The urban industrial target systems were the largest 150 Soviet cities and the largest 250 U.S. cities. Soviet population in the city targets was 82.4 million; U.S. population, 119.6 million. The urban target systems approximate those used in the SIOP and the RJSOP (U.S. version of the Soviet SIOP).

Performance of Soviet ABM

Two performance levels were examined for Soviet ABM. First, it was assumed to be very effective. In this case, interceptor exhaustion had to occur before penetration occurred. The area defense was assumed to be random, the terminal defense, subtractive. The effect of these assumptions is to bring all reliable area and terminal interceptors into battle.

Next, the ABM was assumed to be wholly ineffective. In this case the ABM OB was zero; none of the interceptors got into battle.

These two cases are the extreme possibilities for the performance of a random area, subtractive terminal defense. Other cases, e.g., if rate saturation is possible, would fall between these two extremes. If the performance level assumed results in a low effective OB, the results of the "wholly ineffective" case would approximate the low effective OB assumption.

Soviet Withhold Variations

If the Soviets withhold untargetable forces (e.g., SLBMs or Alert Bombers) to strike U.S. cities, our reallocating weapons from Task C to Task A will not reduce U.S. fatalities at all. If the Soviets withhold only land-based missiles, we have maximum opportunity to reduce U.S. fatalities by Blue weapon reallocation from Task C to Task A. Both these cases are examined.

Soviet Fatality Levels

Blue forces can be divided between Tasks C and A to achieve any given level of Red fatalities from zero to nearly the number of people in the cities being attacked. Data are presented for three levels of Soviet fatalities, 50 million, 60 million and 70 million. These levels were treated as parameters in the study.

Results of Calculations

The tables below show the U.S. fatalities for Soviet ABM, both effective and wholly ineffective, for various other conditions. The tables also show U.S. lives that might be saved if a Soviet ABM is ineffective and we know it is so that our war plans can be adjusted to take advantage of this knowledge.

Table 1A

U.S. Fatalities in Millions
Soviets Withhold SLBMs for Red Task C
Soviet Fatalities - 70 Million

Soviet ABM OB	Performance of ABM		Lives Saved by Knowing ABM is Ineffective
	Effective	Ineffective	
1000 Area			
470 Terminal	80.0	79.0	1.0
2000 Area			
940 Terminal	81.1	79.0	2.1

Table 1B

U.S. Fatalities in Millions
Soviets Withhold SLBMs for Red Task C
Soviet Fatalities - 60 Million

Soviet ABM OB	Performance of ABM		Lives Saved by K ABM is Ineffec
	Effective	Ineffective	
1000 Area			
470 Terminal	79.6	79.0	.6
2000 Area			
940 Terminal	80.2	79.0	1.2

Table 1C

U.S. Fatalities in Millions
Soviets Withhold SLBMs for Red Task C
Soviet Fatalities - 50 Million

Soviet ABM OB	Performance of ABM		Lives Saved by Knowing ABM is Ineffective
	Effective	Ineffective	
1000 Area			
470 Terminal	79.4	78.6	.8
2000 Area			
940 Terminal	80.2	78.6	

These tables show that knowledge of Soviet ABM ineffectiveness might permit saving about .5 to 2.0 million lives for the conditions shown and that lives saved are not very sensitive to Soviet fatality levels. This result was to be expected with SLBMs withheld. The only reason some lives were saved is that the model used assumed that some land-based missiles not alert for the Red Task A strike could be made alert for Red Task C. Additional attrition of these, when ABM is ineffective, saves some lives.

Tables IIA through IIC show the same data if Red withholds land-based ICBMs for Red Task C.

Table IIA

U.S. Fatalities in Millions
Soviets Withhold SS-11s for Red Task C
Soviet Fatalities - 70 Million

Soviet ABM OB	Performance of ABM		Lives Saved by Knowing ABM is Ineffective
	Effective	Ineffective	
1000 Area 470 Terminal	84.5	81.2	3.3
2000 Area 940 Terminal	90.7	81.2	9.5

Table IIB

U.S. Fatalities in Millions
Soviets Withhold SS-11s for Red Task C
Soviet Fatalities - 60 Million

Soviet ABM OB	Performance of ABM		Lives Saved by Knowing ABM is Ineffective
	Effective	Ineffective	
1000 Area 470 Terminal	82.8	80.2	2.6
2000 Area 940 Terminal	87.1	80.2	6.9

Table IIC

U.S. Fatalities in Millions
Soviets Withhold SS-11s for Red Task C
Soviet Fatalities - 50 Million

Soviet ABM OB	Performance of ABM		Lives Saved by Knowing ABM is Ineffective
	Effective	Ineffective	
1000 Area			
470 Terminal	82.2	79.2	3.0
2000 Area			
940 Terminal	84.5	79.2	5.7

These last three tables show that if land-based ICBMs only are assigned to Red Task C, and if ABM OB is large, U.S. lives saved, by knowledge of vulnerabilities in Soviet ABM, would reach as high as 9 - 10 million. In more likely situations, i.e., Soviet ABM turns out to be about like our mid-range projections, U.S. lives saved would be about 3 million.

Additional Aspects of this Problem

Several assumptions used in this analysis can now be analyzed for their implications.

Assumption 1 - Bombers are used only in Task B by both Red and Blue.

Alternative Assumptions

a. Red assigns bombers to Red Task C. The effect of this would be to reduce the value to Blue of knowledge that Red's ABM is ineffective since alert bombers are not targetable.

b. Red assigns bombers to Red Task A. This would give Blue an incentive to withhold SLBMs for Blue Task C, and would increase the total Blue withhold required if Blue insisted on riding out the bomber attack before executing Blue Task C. Such use of Red bombers should not, however, have any pronounced effect on the value of knowing Red ABM is ineffective.

c. Blue assigns bombers to Blue Task C. Since bomber effectiveness is not sensitive to knowledge of Red's ineffective ABM, such use of Blue bombers would reduce the value of knowing about Red's ineffective ABM.

d. Blue assigns bombers to Blue Task A. If Red does not wait until after Blue bombers attack to execute Red Task C, such use of Blue bombers would have no effect. If red did wait, the effect of Blue

bombers would be to reduce the marginal damage of the ballistic missiles reassigned to Task A on the basis of knowledge of Red's ineffective ABM. The net result of such use of Blue bombers would be to reduce the value of knowledge of Red's ineffective ABM.

Assumption 2 - Blue's penetration aid work.

Alternative Assumption

The grossest alternative assumption is that Blue's penetration aids, especially chaff, do not work. The effect of this alternative would be to substantially increase the value of knowledge that Red ABM is ineffective. This is caused by the fact that any reduction in Blue penetration efficiency (ABM interceptors absorbed per offensive booster) forces Blue to set aside more forces if Red ABM is effective.

Assumption 3 - Red's Task C withhold is all in either land-based or sea-based forces.

Alternative Assumption

Red might use a mixed force of bombers, SLBMs and ICBMs for Red Task C to guard against gross failure of any one of these classes of systems. The effect of this is to make the value of knowledge of Red's ineffective ABM fall between the extremes shown in Tables 1A-C and IIA-C. If Red uses many bombers, the value of ABM knowledge could fall below the tabled estimates.

Assumption 4 - City target systems are limited in size about as used in this analysis.

Alternative Assumption

Use larger city target systems. The larger the city target systems, the smaller will be the value of knowledge of Red's ineffective ABM. This is caused by the fact Red's weapons, destroyed by Blue's reallocation on the basis of Blue's knowledge about Red's ABM, are achieving lower average returns against a large city target system than a small one.

Assumption 5 - The scenario used.

Alternative Assumptions

a. Red executes Task C before Blue can strike Red's Task C forces. The estimates derived here will be reduced in any scenario in which Red executes Red Task C before Blue can strike Red's Task C forces.

b. Blue strikes first. The estimates will be reduced if Blue strikes first inflicting higher overall attrition on Red forces. This results from the lower marginal damage done by the missiles Blue reallocates from Task C to Task A in this case.